

## THE CULTURE OF THE SILK-WORM.

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**I**N Louis Figuier's "Insect World" there is a collection of the most valuable known facts in regard to the rearing of silk-worms, and the preparation of silk in its earlier stages. These caterpillars, which become moths, have gained the designation of "the dog of insects," because they have been domesticated from the most ancient times, and have lost a great part of their strength in the process. The cultivated moth is not strong enough to sustain itself in the air, nor even on the leaves of the mulberry, when they are agitated by the wind. The female, always motionless, seems ignorant that she has wings. The male, when on the ground, flutters around his companion, but no longer flies. After three generations of rearing in the open air, the males recover their lost power.

The history of silk cultivation loses itself in antiquity; but China is generally given the credit of possessing the first knowledge on this subject. The name of the Empress Ti-ling-chi is even mentioned as the one who first succeeded in rearing the worms and in unwinding the silk. This is said to have been two thousand six hundred years before our era; and it is also said that, prior to that discovery, the Celestials wore the skins of beasts for clothes. It is questionable if this empress is not a myth, and only a Chinese Ceres who represents the birth and growth of this important agricultural or insect industry. It is certain that the old emperors protected the mulberry-trees by stringent decrees, which encouraged their cultivation and punished their destruction. The exportation of the eggs of the silk-worm was strictly forbidden.

Babylon and India had their silks at very early dates, but probably obtained the material from China.

In the time of Alexander the Great, silk was worth its weight in gold, and was woven so thin, that the women of Greece were scarcely covered by the delicate tissues. Julius Cæsar introduced it into Rome, and sometimes replaced the coarse cloth, used to keep sun and rain from the amphitheatres, with the silks of the Orient. The populace murmured at the taxes involved in the cost, but applauded the greatness which could provide such shows.

Constantinople and Greece furnished Europe with silk-worms for centuries. In the eighth century the Arabs introduced them into Spain. From Greece the caterpillars were taken to Sicily during one of the frequent wars, and thence the art of making silk spread over Italy. France saw this element of her national wealth grow up in the reign of Henry IV.

The silk-worm has nothing alluring in its appearance; it is like an humble workman in a white blouse, with nothing brilliant in its own dress, but giving the whole world its most beautiful and gorgeous array. The body of the silk-worm has thirteen distinct segments. In the front are three pairs of articulated legs; in the middle and

toward the posterior part are five pairs of membranous legs, furnished with a circle of very fine bristles, which assist the animal to hook itself on to leaves and stalks. On the two sides of its body are eighteen stigmata, or respiratory mouths. Its process of gnawing and absorbing the mulberry-leaf is very peculiar. The mouth is provided with six small articulated pieces; a hollow in the upper lip receives the edge of the leaf, and beneath two large jaws cut the leaf as a pair of scissors. Underneath, weaker jaws divide the fragments, and a small organ, articulated on each jaw, pushes them back toward the mouth, and prevents the smallest fragment of the leaf from falling. The leaf, passing into glands, is converted into silk by processes unknown to man. Efforts have been made to obtain silk directly from the mulberry-leaf, but without success, the organs of the insect being laboratories which art cannot substitute. It was once hoped that, by taking from the body of the worm the viscous matter in the glands, silk could be formed. A very inferior, almost worthless, thread was obtained; but it was evident that the silk must not only be elaborated, but emitted by the worm itself. The worm moults several times; in each successive stage it changes its color, and is always remarkably voracious just before the time for moulting. The last interval is the longest, and just before the termination of its caterpillar existence it eats with extraordinary activity. Where there is a large collection of them, the noise their jaws make is like a heavy shower of rain. When the time draws near for its metamorphosis into a chrysalis, the worm becomes restless, wanders away from its food, which it never did before, and seeks for a suitable place in which to establish its cocoon. It begins this task by throwing from different sides threads destined for fixing the cocoon; the proper space having been ascertained by this means, the worm begins to unwind its thread, which it arranges around its body, describing ovals with its head. About the fourth day, after having expended all its silk, the worm, shut up in the cocoon, becomes of a waxy white color; the skin wrinkles; very soon it is detached and pushed downward, and the chrysalis appears under the rents in the skin. In fifteen or sixteen days the moth appears, and escapes from its silken prison by moistening the threads with a liquid, by which they are disunited, but not broken, and through the threads thus separated the insect makes its way to the light of day.

The rearing and culture of the silk-worm is of course an important industry. After procuring good eggs, the most essential point is to possess premises in which the air is easily renewed. The worms must have all the air possible, and yet must never be chilled. This is usually attained by keeping a constant fire in an open room, and by letting air into the room from another chamber which separates it from the open air. In the rearing-room are arranged racks, by the side of which are placed frames made of reeds. These frames are placed in such a manner that one can easily pass round them to place and remove the worms, and to distribute the leaves uniformly. A cellar, or cool room, is necessary in which to stow away the leaves as soon as they are brought in from the country. In large rearing establishments there is a special chamber for incubation. The eggs are spread out on sheets of paper, placed on a table in a room having a southern aspect, taking care that the rays of the sun shall not reach them. After three or four days a fire is lighted, and day by day the heat gradually increased. As soon as the worms are hatched, the eggs are covered with a net, and over them are placed mulberry-boughs, covered with tender leaves, on which all the little worms congregate. They are then lifted off with a hook made of thin wire, and the worms are placed on a table covered with paper. They are given as their first meal tender leaves cut into small pieces. During the first age, the period preceding the first moult, they are fed six or eight times a day, care being taken to distribute the food as equally as possible. When the moult approaches, the young ones are made to climb on to boughs having tender leaves, so that they can be moved to litters as thin and clean as possible, and there sleep in a good state of health. When the mass of worms is well awake again, a net is spread over them, the meshes of which are broad enough for them to pass through. On this net are spread young leaves, and the worms, immediately leaving the old food, proceed to the new. This process is repeated through each successive age. When the last age approaches its termination, and the chrysalis state is near, sprigs of heather are placed so that the worm—which at this period has a great disposition to mount—can ascend into them, and spin its cocoon.

The conditions most important in rearing the silk-worm are, proper and equable heat and thorough ventilation. The most precarious



A Silk-worm Rearing Establishment.

period is the time after the last moult. When the worms awake from their sleep they are liable to various diseases, and hence require the utmost care and watching.

When the cocoons are completed, the person in charge separates

them from the heather, and sells them to the silk-spinners. But the chrysalis within the cocoon must first be destroyed, in order to prevent the moth from piercing its silken covering. This is done by exposing the cocoon to steam, in which the chrysalide is stifled.



Silk-winding Establishment.

The cocoons which are retained in order to produce eggs for the next year are fixed on sheets of brown paper, covered with a slight coating of paste. Male and female cocoons, ascertained by the fact that the female is always the heavier, are kept on separate sheets. When the moths appear, they are seized by the wings and placed on cloths stretched out for the purpose. They presently evacuate a red liquid; the males and females are then placed together; after copulation they are separated. Sheets of paper are placed on screens, suitably inclined, on which the females are laid. Here the moths lay their eggs. The sheets of paper, covered with eggs, are then hung on wires in a room which is never warmed. Here they remain until the hatching-season returns.

Having thus given a rapid survey of the method of rearing the silkworm, a few words in reference to the winding of the cocoon may be of interest. This is an operation requiring great experience, unremitting attention, and an almost exceptional delicacy of touch. The woman who is spinning stands before a sort of loom which is called *tour*. Under her hand is a copper containing water, which she heats to the required degree by opening the top of a tube, which brings a current of steam. She plunges the cocoons into hot water, and moves them about in it, to soften the gummy substance which sticks the silken threads of the cocoon together. Then she beats them with a light hand, with a small birch broom. She now attempts to make up a staple, or *brin*, by uniting together the ends of five cocoons. The five ends are held in a mass, and introduced into the hole of a frame, suited for the purpose. Two staples are made at once, one on the right hand, the other on the left. The worker then brings them together, crosses them, rolls them, and twists them, the one on the other, several times, after which she separates them from above and keeps them well apart, making each of them pass into a hook at a distance from which they are going to twist round into a hank, separately, on a wheel. The two threads thus twisted are drawn close together, compressed, and become one, getting round by rolling on each other, and being kept in continual motion, drawn out as they are by the rapid motion of the wheel.